THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

Solar Bulletin

HARRY L. BONDY, EDITOR 61-30 157 ST., FLUSHING 67, N.Y.

SOLAR DIVISION COMMITTEE: RICHARD W. HAMILTON - AAVSO PRESIDENT; H.L. BONDY, CHAIRMAN
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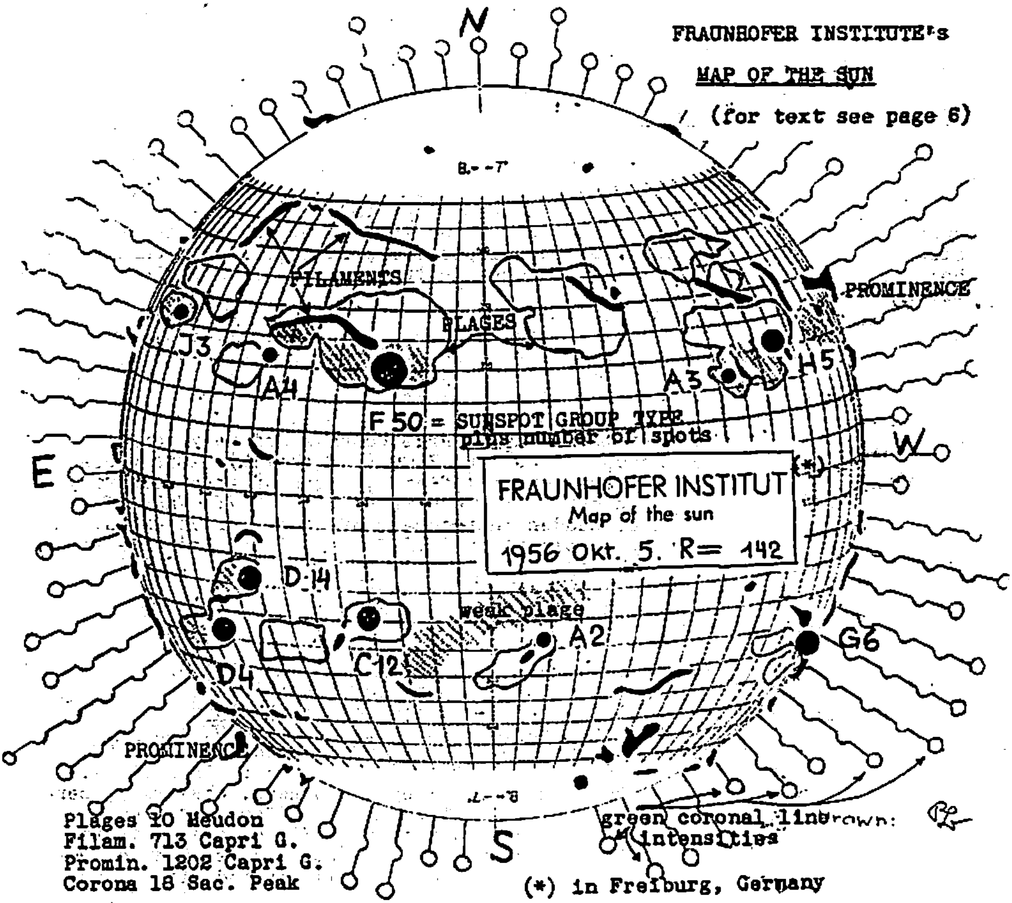
JANUARY-FEBRUARY 1957 NUMBERS: 125-126

FRAUNHOFER INSTITUTE's

MAP OF THE SUN

(for text see page 6)



RADIO EQUIPMENT FOR DETECTING SOLAR FLARES - II,
DAVID WARSHAW'S FIRST RESULTS.

The Solar Division BULLETIN - Nos.121-122 (September-October 1956) carried a detailed description of DAVID WARSHAW's "Solar Flare Indicator". Since then Warshaw was able to employ a recording microammeter /in fact he has two now!/ and thus it is possible to analyze his results objectively. I should add that Warshaw is now fully convinced that the "SEA-receiver" requires a continuous recorder to be of any value.(The SEA stands for Sudden Enhancements of Atmospherics on 27 kc/sec, which are due to the effects of solar flares on our ionosphere.)

There are too many "false alarms" which cannot be identified as such from the mere "alarm" signal. A recorded trace of the "enhancements" is necessary to differentiate between local interference due to electrical appliances, machines or electrical storms within 200 miles on one hand and, on the other, the "footprint" left behind by a flare. There is rather a distinct "shape" of a true SEA, but as there is always at least some minor interference, it requires some praxis to analyze the records properly.

As others have found, Warshaw confirms that best results are obtainable on 27 kc/sec. Currently he is engaged "to reduce the interference problem in my location. I am experimenting with a 'two-feet-square' shielded loop antenna and with 'ten-inch' crossed ferrite loopstics to determine the best for our purpose. The results look promising, however, the long outside aerial is better in interference-free locations".

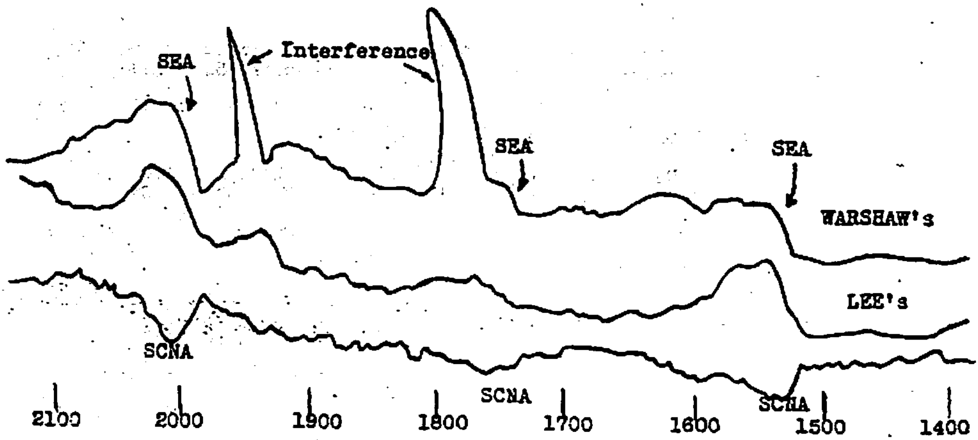
A short time ago nobody would have believed that Warshaw could successfully operate his "SEA-receiver" from a metropolis like New York City. In fact, most experts were quite openly discouraging. However, the results speak for David Warshaw's great skill and the reader may judge for himself from the following examples.

4 OCTOBER 1956: On this day there was a large, complex and very active sunspot group at N20° and E30° (see sketch). This whole region had many repeating flares and sub-flares, signs of great activity. Some of the flare effects on our Earth were recorded by DAVID WARSHAW in Brooklyn, N.Y. in form of Sudden Enhancement of Atmospherics -SEAs. For this same day we have for comparison ROBERT H. LEE's record obtained at the High Altitude Observatory in Boulder, Colorado, and M.A.ELLISON's report from Edinburgh, Great Britain. The two tracings obtained at stations some 2000 miles apart are in very close agreement, as may be seen from the illustration on page 3.

Notes: The first flare was observed at Capri (Italy), as well as at the McMath Hulbert Observatory (Michigan) and at Sacramento Peak (New Mexico). In form of an associated SEA the flare was recorded by Ellison in Edinburgh beginning at 1513 UT, by Warshaw in Brooklyn at 1507 UT and Lee in Boulder at 1504 UT. Notice that the LOCAL TIMES varied from 1513 PM in Scotland, to 1007 AM in Brooklyn and 0804 AM in Boulder. This flare, classified as 2+ by McMath Hulbert Obs. (1+ by the others, observing, perhaps, under less satisfactory seeing conditions) had effects over our whole sunlit hemisphere, causing, besides the said SEA, also a definite Sudden Short Wave Fadeout (SSWF, formerly called SID), Sudden Cosmic Noise Absorption (SCNA, recorded by Lee). It was also associated with a "group" of bursts on solar radio-noise at 2800 Mc/sec as recorded by Covington in Ottawa, Canada, but had no "bursts" on 167, 200 or 460 Mc/sec (Boulder and Cornell reports).

PARALLEL OBSERVATIONS OF SUDDEN ENHANCEMENTS OF ATMOSPHERICS - SEA

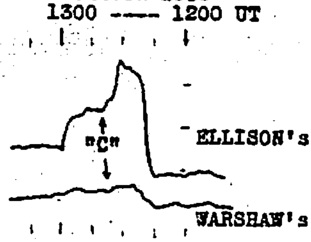
The following tracings are copies from DAVID WARSHAW's recordings compared with parallel observations made by ROBERT H. LEE, High Altitude Observatory, Boulder, Colorado and by M. A. ELLISON, Royal Observatory, Edinburgh, Great Britain.



←--- UT

4 OCTOBER 1956

18 SEPTEMBER 1956
1300 ---- 1200 UT



Mr. Lee's tracing was reduced by means of a pantograph to bring it to the same scale as that of Mr. Warshaw's. The specific times given in the table on page 4 are, however, taken from the original records.

For comparison we show also Mr. Lee's cosmic noise at 18 Mc/sec (lowest trace)

Mr. Ellison's tracing is here reproduced in the same scale as it appears on the original record, however it was "mirror" reversed for comparison with Warshaw's record. The time scales (horizonal) are identical.

Notice that both records show the same time for beginning, that the SEA has its usual "rapid rise"(see the above tracings also). There is also a peculiar "dip" marked C here, which however must not necessarily be considered an identical feature of the SEA.

(continued from page 2)

The second flare (McMath: class 1) at 1724 UT was also clearly associated with a SEA as can be seen on Warshaw's record (see page 3) at 1721 UT. However, it is hardly noticeable on Lee's tracing in either the SEA or SCNA form. Perhaps this difference is due to the fact that this minor flare (according to Sacramento Peak only class 1- /i.e. a subflare/) was effective only in the very subsolar region and much less so in the morning sky at Boulder at 1023 LT (in New York it was at local noon time). If this is so, it points to the need of a rather closer network of stations for detecting all SEAs. (See also the examples below).

Both, the second and the third flare which occurred at 1950 UT, and their respective SEAs, were associated with fade-outs (~~Slow-~~SSWF).

TABLE OF EVENTS ON 4 OCTOBER 1956

	flare class	obs.	beg. UT	2800 Mc/s bursts	SEA UT	SEA Obs.	SCNA UT	SCNA Obs.	Fadeout UT
A)	2+	McMath	b1513	1507	1504	Lee	1505	Lee	SSWF 1511(2+)
	1+	Capri	1510		1507	Warshaw			
	1+	Sac. P.	1512		1513	Ellison			
B)	1	McMath	1724	none	1721	Warshaw			Slow-SSWF
	1-	Sac. P.	1720		1723	Lee	1721	Lee	1720 (1+)
C)	1	McMath	1950	1953	1944	Lee	1945	Lee	Slow-SSWF
	1-	Sac. P.	1950		1951	Warshaw			1955 (2-)

Footnotes: McMath=McMath Hulbert Observatory; Sac. P.=Sacramento Peak Obs.; SSWF=Sudden Short Wave Fadeout; number in parenthesis gives the classification of the fadeout on a scale 1- to 3+; b1513 means flare started before this time; SCNA=Sudden Cosmic Noise Absoption on 18 Mc/sec.

Another interesting parallel example occurred on <u>18 September</u> 1956. On this date, <u>Ellison</u> in Edinburgh recorded a SEA at 1215 UT (<u>noon</u> local time) and at the same time (but <u>local time</u> 0715 AM) <u>Warshaw</u> /some 3500 miles away/ recorded the very same SEA too. As can be seen on the illustration, there is excellent agreement between the two stations' times of beginning. Notice also a "dip" marked C on our copy. The Edinburgh record shows a far more intense "enhancement" than the one obtained in Brooklyn, showing clearly the diurnal effect. This SEA was caused by a flare observed at Meudon, France, at 1220 UT, class 1, and was also associated with a burst on 2800 Mc/sec. recorded in Ottawa at 1218 UT. A SCNA was also recorded by Ellison at 1232 UT. A fade-out occurred at 1215 (SSWF, 1+). (Boulder was before sunrise).

Were it not for the fact that Warshaw's tracing shows a fairly stable level before and after the SEA, it would have been difficult to confirm the flare from here. (Records obtained from two or more stations, separated considerably in longitude, may permit a closer study of the conditions pertaining to the D-layer, as Dr. Zirin has shown at the recent AAS meeting from SCNA records.)

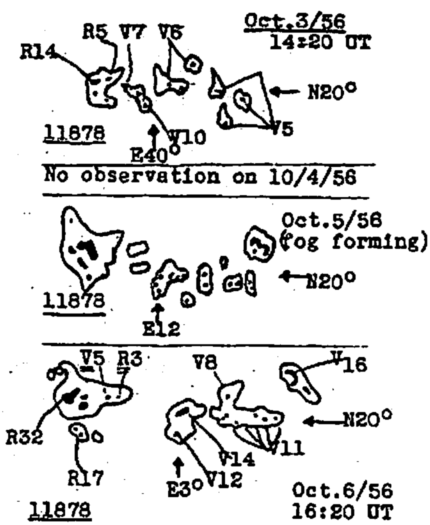
Another parallel observation of a SEA occurred on 6 OCTOBER 1956. Ellison's times for beginning, maximum and end of the SEA are: 1417, 1422, 1500 UT. Warshaw's respective times are: 1415, 1422, 1500. A subflare was observed at Sacramento Peak at 1405, 1416 max., and ending at 1500 UT. A burst on 2800 Mc/sec was recorded at Ottawa at 1416 UT. The associated fade-out was recorded from 1417 to 1440 (confirmed, class 1).

A more complete tabulation of Warshaw's records will be published here in a subsequent issue. In the meantime we know that congratulations are due to David Warshaw for his very fine work.

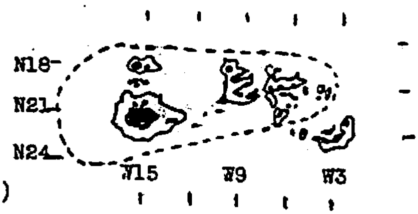
The SOLAR DIVISION has several members building "SEA-receivers" following Warshaw's model. GEORGE R. WARREN, West Chester, Pennsylvania, one of our experienced solar observers and expert radio-ham, completed his set during November. PHILIP J. DEL VECCHIO, Paterson, New Jersey, completed his set in December. W. VAL ISHAM, Columbus, Ohio, has his unit in operation now. Another one is teing build by PETER SMITS, Port Elizabeth, SouthAfrica. We have reports from others and will keep you informed on the progress of this program. It would be particularly interesting to see some of these sets in operation in Canada, the Great Plains region and in the North-West.

The SOLAR DIVISION will act as center to coordinate and assist serious amateurs in this work, and, upon evaluation of all records, will make the particular data on SEAs available to the National Bureau of Standards and to any qualified institution or individual. This may become one of our most serious contributions to the forthcoming International Geophysical Year (IGY).

Harry L. Bondy
Chairman, Solar Division-AAVSO



Mt. Wilson group 11878 as recorded with the 150' tower telescope.



7 October 1956 0544 UT
copy from a photo by Demetrius P. ELIAS, National Observatory of Athens.

---- the region where all flares were observed

Mt. Wilson Observatory classified group 11878 as a βp on Oct.3; simply β on Oct.5, because no magnetic polarities could be measured; $\beta\gamma$ on Oct. 6, 1956.

FRAUNHOFER INSTITUT's DAILY MAPS OF THE SUN.

Since 1956 January 1, the Fraunhofer Institut in Freiburg im Breisgau, Germany, publishes under the direction of K.O. Kiepenheuer "Daily Maps of the Sun". A sample of their maps is reproduced on page one. These maps replace their former publication called "Sonnenzirkular", which contained their sunspot numbers, sunspot group evolution tables, flare data, green and red coronal lines intensities with synoptic maps, and cosmic ray intensities.

The Daily Maps of the Sun illustrate graphically the position, number and group type of sunspots. Full circles in three sizes show the Zürich group types; smallest for A,B,C,J; medium for D,G,H; largest for D,E,F. The sunspot data, based on observations made in Freiburg and/or Istanbul, Kanzelhöhe, Potsdam, Wendelstein, are also used for a simple, unreduced "sunspot-number" R.

The outer contours of plages (chromospheric faculae) are taken from Calcium (K3) spectroheliograms. The regions of the weakest plages are shown as a hatched area without an outline; those of average intensity with a line outline; the brightest regions are hatched within an outline.

The true form of filaments (=the prominences projected upon the solar disc) is shown as revealed in Hα (Hydrogen) spectroheliograms. The limb prominences are also shown in their true form.

The intensity of the green coronal line is shown schematically on a five step scale. Note that this does not mean the extent, but only a rough contour of isophotes.

Flares are noted by location, class, time and observatory name on the side of the forms. The data compiled by different observatories and used in each map are named together with the times of their observation. Thus information based on reports from all parts of the globe is presented on a Stonyhurst-Disc-like map.

It must be understood that of necessity (the limitation of time) the maps cannot be considered as perfect. Indeed, at times sunpot groups are missing or classified incorrectly. But this is not the purpose, as detailed data of all phenomena are published by other institutes and observatories in final form. What the Fraunhofer maps accomplish very successfully is the presentation of all major centers of solar activity and thus they enable one to follow the daily progress of the active regions, which then, in turn, may be used in a study of related terrestrial phenomena.

For a detailed description of "Solar Activity" see K.O. Kiepenheuer's fine chapter in "The Sun", Vol. 1 of "The Solar System", edited by Gerard P. Kuiper (1953).

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Editors note: We still receive mail to our old address, which causes additional delay in the postal service. Please note again:
NEW ADDRESS:

SOLAR DIVISION-AAVSO
61-30 157 Street
Flushing 67, N. Y.

ON THE ANNULAR ORGANIZATION OF SUNSPOT GROUPS

by James C. Bartlett, Jr.

It should be recognized that a completely successful theory of sunspots must account not only for the origin, periodicity, reversal of magnetic polarity with change of cycle, the drift of the sunspot zones and other characteristics, but also explain the various types and forms of organization we see in sunspot groups.

In this paper attention is directed to a rather rare type of spot organization, and yet one which occurs frequently enough to warrant serious consideration. This type I shall call the "annular-type".

The "annular type" of spot organization appears in some variation of the circle, ranging from an almost perfect circle to a flattened ellipse. The "annular-type" therefore is a "ring group" in contrast to the formation of a "line-group" of the ordinary bi-polar configuration. The rarity of "ring groups" is suggested by the fact that my own records contain only 76 examples out of 2,547 sunspot groups observed through the last 16 years.

The "annular type" of organization may be divided into two sub-types: the "perfect ring" or annulus and the "half-ring" or semi-annulus. Of these, the former is much the rarer type and I note but 18 samples since 1940. However, the same records show 58 examples of the "semi-annulus" type since then, making it about 3 times as common.

The apparent characteristics of "ring groups" are not remarkable. The "ring", whether an "annulus" or "semi-annulus", consists of ordinary, separate spots which vary in size from large to mere dots. As a rule, even the smaller spots reveal concentric penumbrae.

The number of spots in an "annulus" or "semi-annulus" shows no fixed relation to the size of the formation. From 15 to 20 small spots may occur, sometimes in pairs, or there may be only a few large ones. In the latter case the large spots themselves will be curved to form arcs of the ring. Very rarely, there will be seen a more or less continuous ring of a penumbra in which small umbrae lie embedded.

In the "closed ring" there is no clear distinction between "leader" and "follower", though not all of the spots need be of equal size. Occasionally one or more spots in the "ring" will be of considerably greater size than the others; but there does not appear to be any fixed position in the "ring" at which such larger spots occur. I have seen them in all positions in the grouping.

The much more common "semi-annulus" consists again of two types- the regular or "closed" type and the more irregular or partial type, the "open-semi-annulus".

The annular features may be found in form of an integral sunspot group and again as a component of a group. Annular "sub-groups" are much more common than those forming a whole, integral sunspot group.

Of 58 "semi-annulus" types observed by me, exactly 29 appeared in the Southern Hemispehere and 29 in the Northern. Of 15 "annulus" types 8 were in the Southern and 7 in the Northern Hemispehere.

"Sub-groups" are more common than integral groups. Of 78 mixed examples /comprising "annuli" and "semi-annuli"/, 44 were "sub-groups" and 34 were integral groups. Of the 58 "semi-annuli" observed, both groups and "sub-groups", the "open-type" is a little more common than the "closed" one: 37 "open" types, 21 "closed" ones.

In respect to "open-semi-annuli" types, the opening is generally facing North or South, rarely East or West. Of 37 "open-semi-annuli" 20 showed a North or South distribution, of 11 "semi-annuli with the opening on the North side, 5 occurred in the Northern Hemispehere and 6 in the Southern. However, of 9 "semi-annuli" with the opening on the South side, no less than 7 occurred in the Northern Hemispehere. East and West preferential openings were more nearly comparable in both hemispheres.

In one respect the "annular types" differ significantly from other forms of sunspot groups and that pertains to their duration. It was possible to fix the approximate duration of 11 "annular" form types and of 32 "semi-annular" types. Both the "annulars" and the "semi-annulars" had a mean lifetime of just one day. This pertains only to the lifetime in these particular forms and not to the lifetime of the whole evolution of the group.

Of the 44 "annular" formations /comprising both "annuli" and "semi--annuli"/ the greatest age observed was 9 days /a single example/, while no less than 75% had lives of less than one day.

The rarity and brevity of the "annular type" of sunspot groupings indicates probably some abnormal manisfestation of the group forming process.

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BOOKSHELF:

"CLIMATIC CHANGE, Evidence, Causes, and Effects" edited by Harlow Shapley; Harvard University Press, Cambridge, 1953 - 318 p., $ 6.00.

reviewed by Andrew R. Wallbillich.

"Climatic Change" is a collection of papers presented at a symposium at the New York Academy of Arts and Sciences in May 1952. These papers were presented by well known authorities in the fields of meteorology, astronomy, geology and the biological sciences. All these fields of science are concerned either directly or indirectly with climate and its variations.

It is my purpose here to review those articles dealing directly with the sun as the causative agent of weather and climatic fluctuations.

In chapter I, "On Climate and Life", Harlow Shapley discusses many of the questions raised and at least partially answered at an open circle discussion at the symposium. These included questions on how life originated on Earth, how it survived the severe climatic changes in the past and whether other life bearing planets similar to the Earth exist around other stars in the universe. If this chapter does not answer all ones questions, it most certainly provides a fertile field for the imagination and one can take the discussion from there. The chapter was well written and although quite technical in spots, the author explains the terms used beforehand.

Chapter IV on "Atmospheric and Oceanic Circulation as Factors in Glacial-Interglacial Changes of Climate" by Hurd C. Willett, is a long and interesting one. The main feature of the chapter is a discussion of various theories of climatic change and how they are brought about. It is found that the climatic changes in both hemispheres are in phase and that they have just about the same amplitude in both hemispheres. This leads one to seek a source, or causative agent, outside the Earth and the author turns to the sun as the prime mover of climates. It is pointed out that both glacial and non-glacial climates tend to perpetuate themselves, therefore one must again seek a source outside the Earth, for once extensive glaciation got started it would tend to continue and vice-versa. It is known that solar radiation, especially the corpuscular type, can cause chemical changes in the ionosphere which liberate heat, especially when original conditions are again established and this heat eventually works its way down to the troposphere. Also, the geomagnetic properties of the Earth are affected similarly.

It is postulated by Willet, that as the solar constant gradually changes (see SD Bulletin Nos. 123-124 and 119-120 articles by Leith Holloway), the belt of prevailing westerlies and the storm tracks gradually move southward bringing more cloudiness, cold air and precipitation with them. Summers remain cooler and more cloudy, the winter snows do not melt completely and over the years a glacier is finally built up over the continental regions. For interglacial and non-glacial periods just the reverse applies.

Chapter V on "Radiation Balance of the Earth as a Factor in Climatic Change" by Harry Wexler, discusses the various theories of radiation balance as affected by changing albedo, CO_2 content of the atmosphere, sunspot cycles and volcanic activity. It has been found that the CO_2 content of the atmosphere has changed over the years and that this can and has affected the absoption and transmission of certain wavelengths thus altering the radiation balance. Volcanic activity could affect the climate if the nuclei were able to attract water vapor and thus increase the natural cloud cover and precipitation.

Chapter VI "The Insufficiency of Geographical Causes of Climatic Change" by John Wolbach discusses some of the theories relating to land formation, continental drift etc, and their influence on climate. It then is shown that the present day structure of the earth seems to be the normal one existing for thousands of years. Several studies which point to a definite 10 to 14 year climatic cycle and others pointing to cycles of 1500 to 4000 years are cited.

In chapter VII "On the Causes of the Ice Ages", Dr. Donald H. Menzel proposes a theory showing that the magnetic lines of force around the Earth instead of acting as a protective umbrella sometimes "bend" or "give" under the action of heavy ionic radiation from the sun. This radiation is absorbed by the atmosphere and tends to heat first the upper and then the lower levels. This process follows the 11-year cycle.

Chapter VIII by Dr. Barbara Bell is entitled "Solar Variation as an Explanation of Climatic Change". This is a general discussion of the theories of "glacial ages with low solar constant" and also those with a high solar constant. It is postulated that the ice ages develop on a rise to maximum solar activity after a general decrease or minimum in activity, this decrease precooling the polar seas and landareas preparing them for the general glaciation. Cooler temperatures and increased moisture content are both needed for a glacial period to develop.

This concludes the chapters dealing directly with various solar factors that have been observed and their known or suggested influence on the climate of the Earth. The remainder of the book deals with meteorological and geological manifestations of climatic change over the centuries.

I would certainly recommend "Climatic Change" as a must for the library of any avid solar observer. There is a wealth of information in every chapter.

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THE SUN by Giorgio Abetti,
translated by J. B. Sidgwick; The Macmillan Co., New York, 1957, 336 pages, $ 12.00.

The chapter "Solar Physics" in Volume IV of "Das Sonnensystem" (1929), part ofaseries called "Handbuch der Astrophysik" was written by Giorgio Abetti and was considered standard text until Waldmeier's "Ergebnisse und Probleme der Sonnenforschung" appeared during the Second World War. In 1934 Abetti wrote a more popular book on the sun, "Il Sole", which was translated into English in 1937. This volume was deservedly quite popular, for it had a concise text and many excellent photographs. In 1951 a new, revised and enlarged edition of "Il Sole" was published in Italy. It is this volume, with further revisions and additionas, that was translated into English by J. B. Sidgwick in 1955.

Thus, after about twenty years, the English reader may once again enrich himself with an Italian classic.

In his Introduction, Abetti deals briefly with the historical background of solar astronomy and in Chapter I, he discusses and illustrates the old familiar ways of solar observing as well as the more modern tools of research. Chapter II describes the photosphere, sunspots and faculae, their charcteristics and behavior in the solar cycle.

Here, regretfully, we find an ugly picture /page 65/ illustrating the "Wilson effect" by means of a monstrous "spot" on the equator. It is also difficult to understand why the old and obsolete Zürich classification of spot groups is shown /page 82/ and discussed in the text and this is further compounded with a footnote explaining that the series of roman numerals designating group types "has since /1939!/ been replaced by the letters A,B,C,...H". Alas, it does not help to call type I, type A, if the former is defined as "small pores"; nor is "V" largest, since the F-type is sixth in order (the old classification did not contain the C-type), and "VIII" is not H, but J-type /i.e. ninth/, neither of which is necessarily only "a single spot", but merely "unipolar".

Chapter III describes the wealth of information we get from monochromatic views of the sun. This is the longest and best part of the book.

Here we learn about the chromosphere, the plages /still called "floculli"/, about flares and prominences. Some fundamentals of spectroscopy are given in detail and many diagrams and photographs make this a very rich chapter for the reader.

Chapter IV deals with the solar corona and solar eclipses, while chapter V describes the "Physical Constitution of the Sun". Many astrophysicists believe now that the socalled "proton-proton" cycle is the more fundamental process in our sun and not the "carbon-nitrogen cycle" converting Hydrogen into Helium and thus supplying the sun with immense energy.

Chapters VI and VII deal with solar radiation and "The Sun as a Star" respectively. Figure 87 /p.291/ shows the usual H-R diagram of stars in order of their absolute magnitudes and spectral types together with names of many familiar stars instead of giving bare black dots. This gives the diagram an additional dimension -an important one- one we might call "familiarity" and you do not have to (like this writer often did) dig out the information from other sources and pencil the names in.

The last chapter, VIII, deals with the challenging problems of the complex "solar -terrestrial relationship", a topic described in detail in another excellent book by Macmillan, written by M.A. Ellison recently. A brief bibliography and index conclude this book.

This volume should be a fine addition on anyone's shelf. The profuse and excellent photographs made, perhaps, this book a $ 12.00 seller.

hlb

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ED. NOTE: Members of the Solar Division-AAVSO may get ABBETTI's "The Sun" with a 10% discount from: Herbert A. Luft, 42-10 82nd Street, Elmhurst 73, N. Y.

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EDITORIAL:

Starting with the current January-February issue, this publication of the SOLAR DIVISION-AAVSO will be called SOLAR BULLETIN. Many of our readers used to refer to our "Solar Division Bulletin" simply as "Solar Bulletin", and we see no reason why this should not be adopted as our title.

We are happy to publish this new format which permits us to print more material for our readers. In the past we tried to get out one issue of our bulletin each month. However, since it became abundantly clear that under our working circumstances it was impossible to live up to this plan, bimonthly issues became a reality. Henceforth, the SOLAR BULLETIN will be published bimonthly as a rule.

Readers, who are interested to get Sunspot-Numbers monthly, should kindly notify this Editor, so that their names may be added to a special mailing list. Thanks to Dr. Sarah J. Hill, Whitin Observatory, who also computes the American Relative Sunspot Numbers -R_A'-, we shall publish again complete summaries of our sunspot-number observations in the near future.

We should be highly pleased to hear what our readers think about the new SOLAR BULLETIN.

Harry L. Bondy, Editor

AMERICAN RELATIVE SUNSPOT NUMBERS R_A, for DECEMBER 1956.

1.....183	9.....164	17.....163	25.....195
2.....147	10.....147	18.....100	26.....199
3.....155	11.....153	19..... 94	27.....186
4.....175	12.....185	20.....112	28.....190
5.....155	13.....171	21.....134	29.....160
6.....146	14.....211	22.....151	30.....153
7.....149	15.....152	23.....160	31.....170
8.....148	16.....161	24.....185	

Monthly Mean for December R_A': 159.8

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ZÜRICH PROVISIONAL SUNSPOT NUMBERS R_Z for DECEMBER 1956 dependent on observations at Zürich Observatory and its stations in Locarno and Arosa.

1.....163	9.....165	17.....174	25.....229
2.....145	10.....204	18.....156	26.....216
3.....169	11.....229	19.....151	27.....215
4.....194	12.....200	20.....130	28.....202
5.....190	13.....184	21.....173	29.....185
6.....175	14.....218	22.....193	30.....168
7.....173	15.....198	23.....215	31.....174
8.....157	16.....186	24.....219	

Monthly Mean for December R_Z: 185.5

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MONTHLY MEAN VALUES OF SOLAR FLUX AT 2800 Mc/sec. (10.7 cm) recorded at NATIONAL RESEARCH COUNCIL - Ottawa, Canada

Flux in watts/m^2/cycles/second bandwidth ($x\ 10^{-22}$) - 2 polarizations

Jan...139	Apr...166	Jul...163	Oct...200
Feb...166	May...163	Aug...194	Nov...247
Mar...160	Jun...154	Sep...200	Dec...249

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POLAR SUNSPOTS?

The present 19th solar cycle is already outstanding in many aspects. Among these is also the number and longevity of high latitude sunspots. The following is an interesting report from Mr. Frank DeKinder, Montreal: "I had an exceptionally favourable observation on November 14, 1710 UT /seeing E2/ when I noticed without any doubt two very tiny spots, one might really term them pores, but quite disdinct, at latitude 80°N and longitude 25°E of CM. At the same time a tiny but brilliant "white spot" (=polar facula) was seen at lat. 85°S and 16° W". We would greatly appreciate to learn if anyone else saw the "polar spots".